Molecular Computing using RNA

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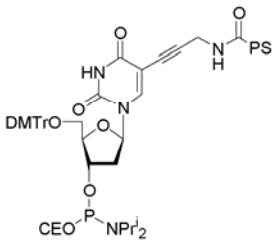
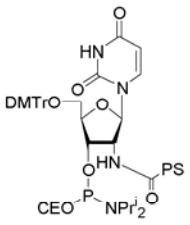
There has been considerable interest in the potential of nucleic acid computing since Adleman first solved a "Travelling Salesman" problem using DNA in 1994. In the wake of this seminal publication, the feasibility of preparing Turing machines based upon the splicing function of RNA has been proposed. To-date such devices have not been fabricated, although workers in Bochum, Germany have prepared an engineered twin-ribozyme capable of such activity. One potential mechanism for achieving programmable splicing might be the incorporation of a conformational switches such as the azobenzene- and spiropyran-derived moieties reported by the groups of Willner and Komiyama for both protein enzymes and DNA. The majority of tethers used by Komiyama and coworkers to append such moieties to DNA are non-nucleotidic and therefore the information in the molecule is lost.

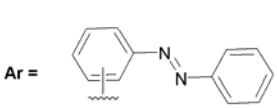
Workers in the Vyle group have recently prepared nucleoside phosphoramidites which would allow the incorporation of photoswitches (PS) into either the major groove (**1a, b**; Figure) or minor groove (**2a, b**; Figure) of RNA. We wish to incorporate such moieties into the Müller twin ribozyme at conserved sites and observe both conformational switching and also programmable splicing.



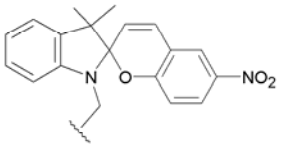
1 b, c



2 a - d



1, 2 a - c



1, 2 d

The EPSRC National MS service centre at Swansea has recently helped confirm the identity of short model DNA and RNA sequences bearing some of these modifications and hopefully will aid in identifying the identity of the longer sequences proposed in this research.